



## **Ecotoxicological evaluation of the effects caused by transformation- and byproducts from chemical treatment**

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# Ecotoxicological evaluation of the effects caused by transformation- and byproducts from chemical treatment

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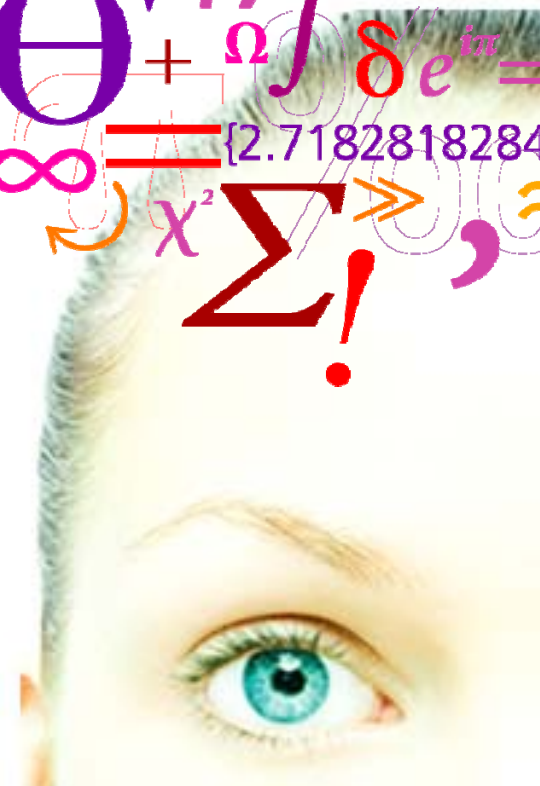
$$f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^i}{i!} f^{(i)}(x)$$

$$\int_a^b \epsilon \Theta^{\sqrt{17}} + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$$

$$\chi^2 \Sigma!$$



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# 1.st objective of study

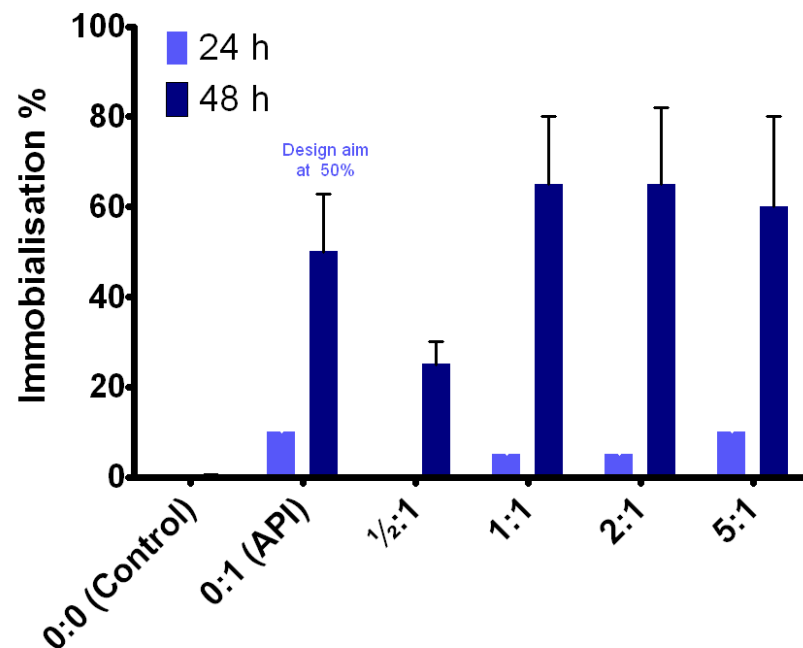
**Does  $O_3$  or  $ClO_2$  treatment of pharmaceuticals create toxicity?**

**Treatment of mixture of 114 pharmaceuticals with molar ratios of oxidants from  $1/2:1$  to  $5:1$ .**

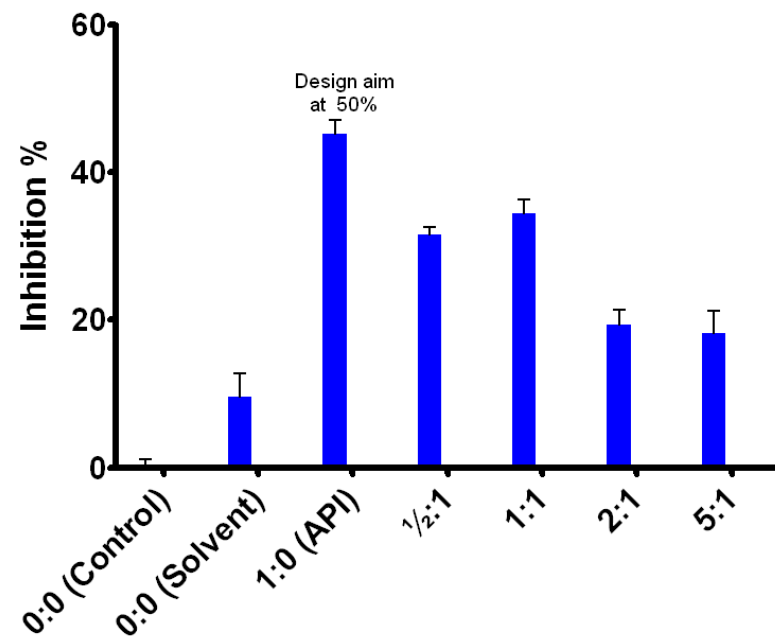
**Test at concentration equal to  $EC_{50}$  of the untreated mixture to detect increase or decrease in toxicity.**

## Ia. Ozonation of pharmaceuticals

*Daphnia magna* immobilisation, O<sub>3</sub>



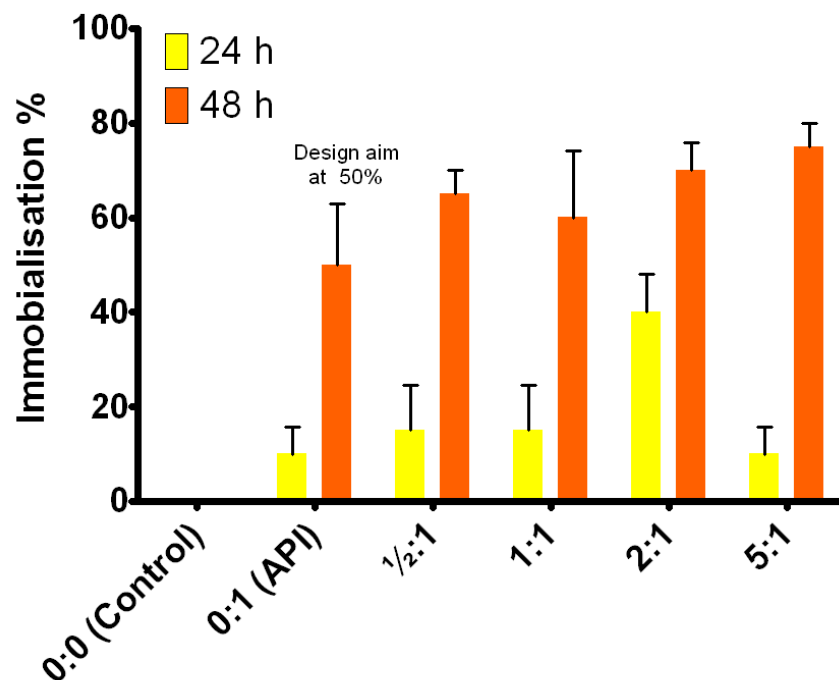
*P. Subcapita* growth inhibition, O<sub>3</sub>



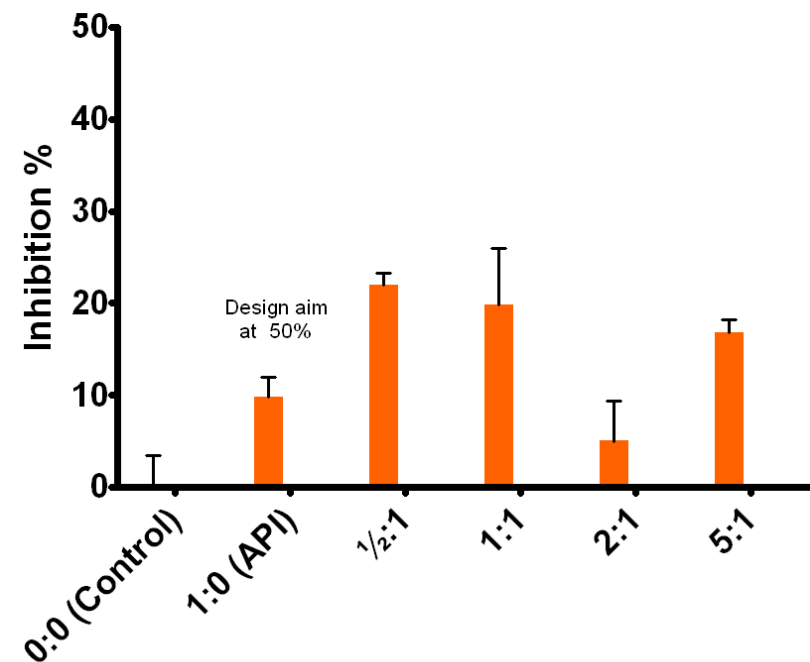
Treatment of water spiked with 114 pharmaceuticals with ozone did not change the toxicity to *Daphnia*, but a dose dependant trend for reduced toxicity was seen in the alga toxicity.

## Ib. ClO<sub>2</sub> treatment of pharmaceuticals

*Daphnia magna* immobilisation, ClO<sub>2</sub>



*P. Subcapita* growth inhibition, ClO<sub>2</sub>



ClO<sub>2</sub> did not as change the toxicity to alga, but a trend for increased *Daphnia* toxicity is seen after 48 h exposure.

## 2nd objective of study

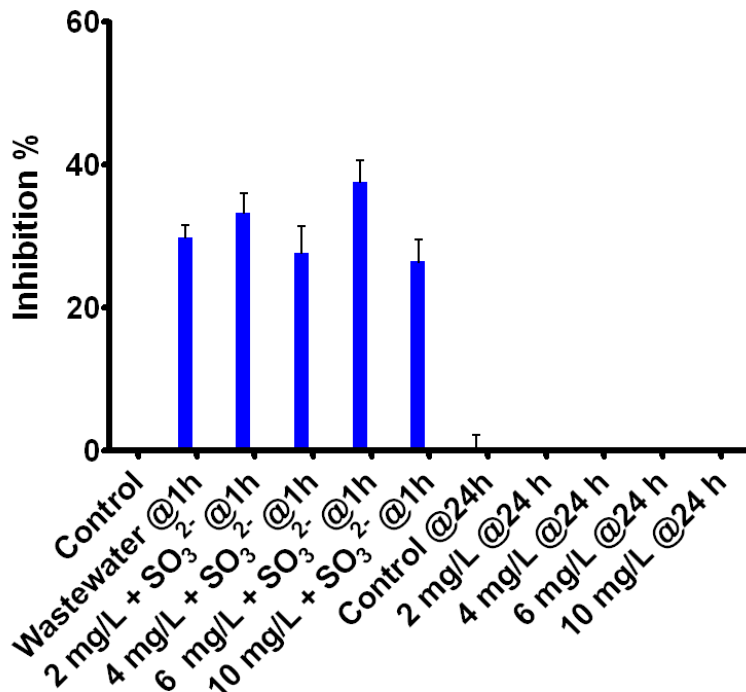
**Does  $O_3$  or  $ClO_2$  treatment of wastewater create toxicity?**

**Treatment with oxidant concentration 2-10 mg/L.**

- I. Start test by destroying residual with sulphite after 1h treatment.**
- II. Start test after 24 h with no residual destruction.**

# Ozonation of biologically treated wastewater

*Alga (P. Subcapita) growth inhibition*  
*O<sub>3</sub> treated WW*

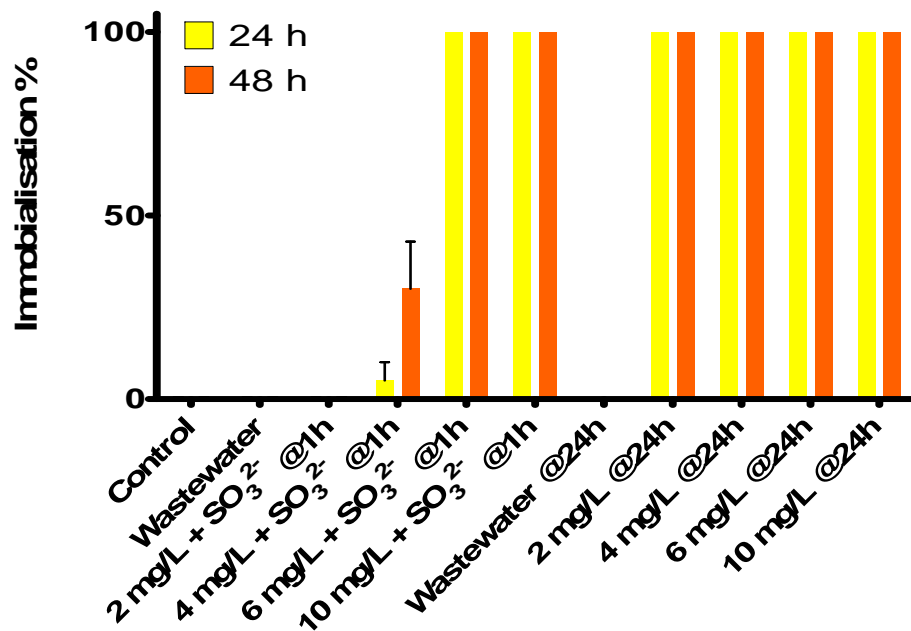


No effect on Daphnia !  
 The toxicity of WW to alga did not change in the 1h experiment with dose.

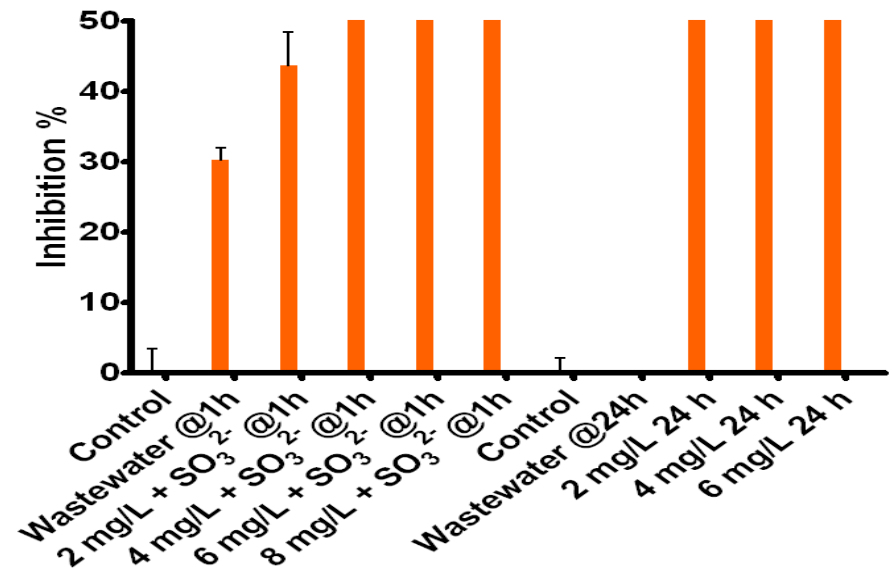
In the 24h treatment the alga control growth was lower than all test concentration, which makes the results unreliable.

# ClO<sub>2</sub> treatment of biologically treated wastewater

*Daphnia magna* immobilisation, ClO<sub>2</sub>



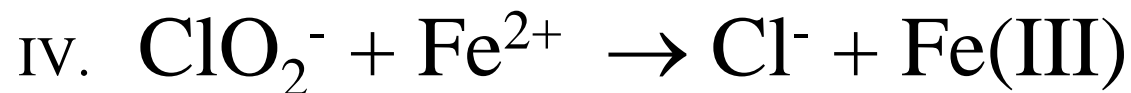
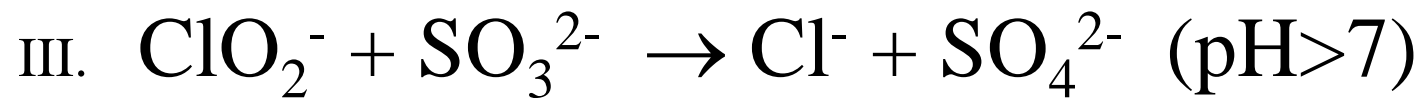
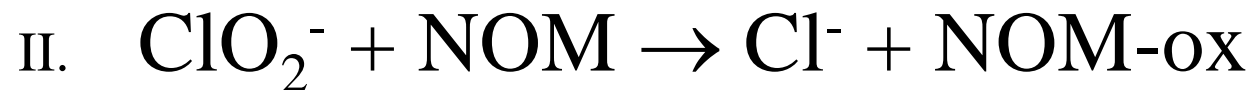
*Alga (P. Subcapita)* growth inhibition ClO<sub>2</sub> treated WW



ClO<sub>2</sub> did not change toxicity at 2 mg/L, but at 4 mg/L and higher significant toxicity was seen to both alga and *Daphnia*. Chlorite residuals (ClO<sub>2</sub><sup>-</sup>) is suspected to be responsible. (Control growth in alga @24h is too low)



## Reactions



# Thank you for your attention!!!!

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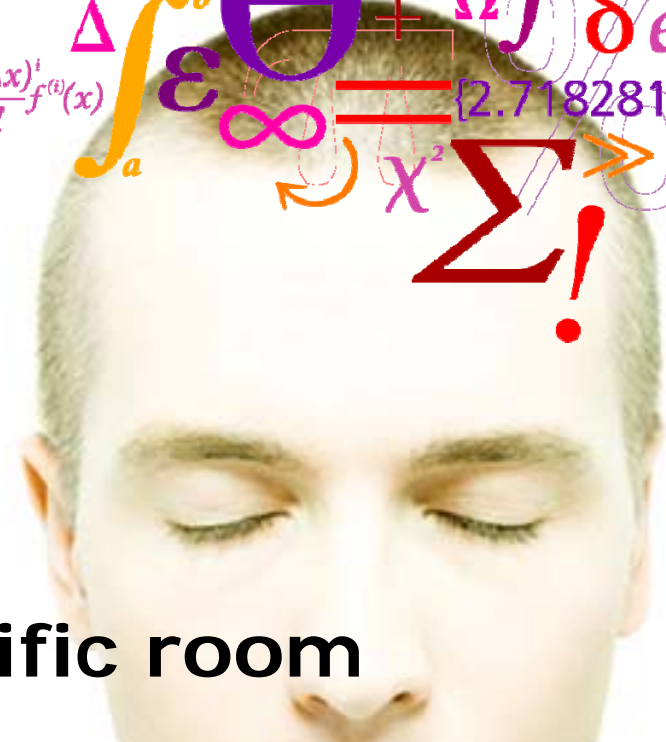
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$$\int_a^b \epsilon \Theta^{\sqrt{17}} + \Omega \int \delta e^{i\pi} = [2.7182818284]$$

$$\infty = \chi^2 \Sigma! >$$



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